NCMA-TEK 49

An Information series from National Concrete Masonry Association

Concrete Masonry Sizes, Shapes, Forms, and Functions

Introduction

The versatility of concrete masonry is vividly demonstrated by the range of sizes and shapes of units being manufactured today. Forty years ago, inventory of a typical block manufacturing plant consisted of less than 30 different sizes. Today, this figure exceeds 100 and the total number of different sizes, shapes and types manufactured across the country is well over 700. As well as reflecting the mounting variety of applications of concrete masonry in todays construction, this increase results from the ability of the manufacturer to provide the units necessary for the many functions that may be required. Units are made in sizes which range from one inch in thickness and in lengths up to twenty four inches; they are solid or hollow and are made with dense and lightweight aggregates so that the concrete of which the units are formed may have controlled density from less than 70 lb./cu. ft. to more than 140 lbs. per cubic foot, and average compressive strength up to 7500 psi.

Concerning sizes and shapes, a group of units has evolved over the years which provide sufficient versatility to handle most wall projects. These are generally referred to as "standard" where reinforced masonry construction is widely used but may be considered as special units where this type of construction is scarce. The name designating various units has been fairly well standardized and usually relates to the function in the wall. Several such units are shown in Figure 1 where the configuration implies the use for which the block is intended.

After modular standards were introduced the concrete masonry industry adapted production to these standards and today all plants can furnish standard units of a nominal size which will fit the 4" module. The nominal dimension includes 3/8" allowed for the thickness of a standard mortar joint, so the actual dimensions of the well known 8" x 8" x 16" unit are manufactured as 7-5/8" x 7-5/8" x 15-5/8".

ASTM Specifications permit a maximum variation in overall dimensions (length, width and height) of plus or minus 1/8" from the actual dimensions specified by the manufacturer. It is the usual practice, however, to manufacture the units within a tolerance of plus or minus 1/16".

TABLE 1
Minimum Thickness of Face-Shell and Webs
(Applies to ASTM C 90-70 Only)

Nominal Width (W) of Units, in.	Face-Shell Thickness (FST) min, in.*	Web Thickness (WT)	
		Webs,* min, in.	Equivalent Web Thickness, min, in./lineal ft.**
3 and 4	¾	¾	1⅝
6	1	1	2¼
8	1¼	1	2¼
10	1⅜	1⅛	2½
	1¼***		
12	1½	1⅛	2½
	1¼***		

* Average of measurements on 3 units taken at the thinnest point.
** Sum of the measured thickness of all webs in the unit, multiplied by 12, and divided by the length of the unit.
*** The face-shell thickness (FST) is applicable where allowable design load is reduced in proportion to the reduction in thickness from basic face-shell thicknesses shown.

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Variety of weights manufactured is reflected by the latest ASTM Specifications for load-bearing concrete masonry units. Two categories of lightweight units are listed: units having a density of less than 105 lb/ft³; a "medium weight" category includes units having a density of 105 to 125 lb/ft³; units weighing 125 lb/ft³ or more fit into the category of "normal weight". Maximum water absorption permitted depends upon weight category, recognizing the fact that lightweight aggregates contain pores which can absorb water even though the concrete of which they are made is well compacted.

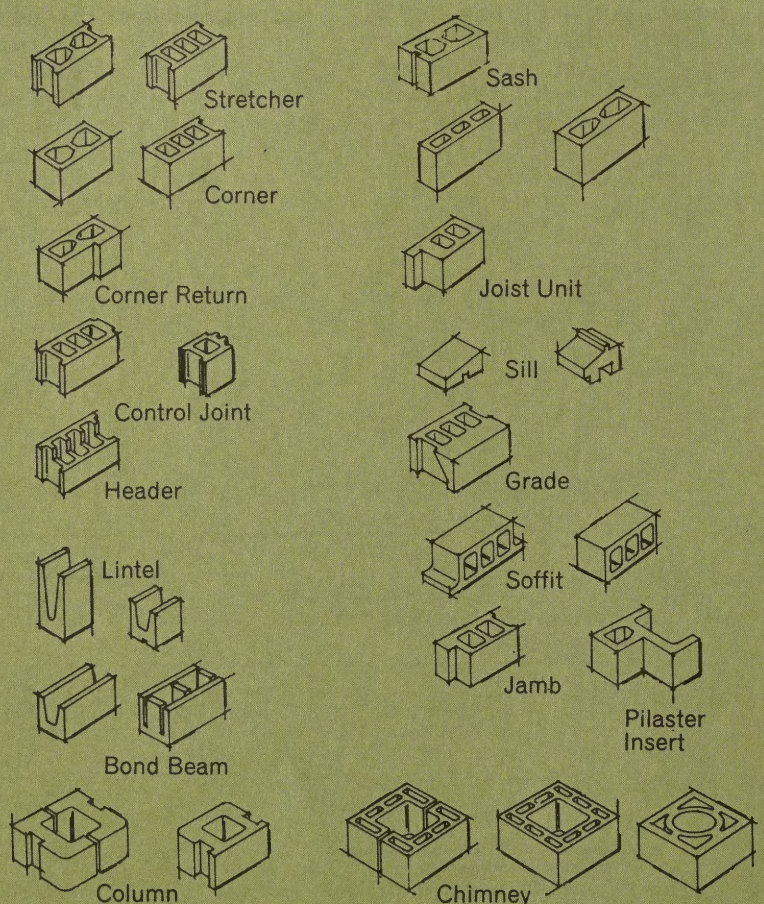
For load-bearing hollow concrete masonry, Table 1 lists the minimum face shell and web thickness requirements as related to the width, or thickness of the unit. Although these thicknesses may vary slightly from plant to plant the minimum values can be used to estimate properties for preliminary design. Table 2 shows estimated net area of block, and section modulus for various wall thicknesses.

Although the industry has standardized on exterior dimensions of modular units, differences in thickness of face shells and webs, and size and number of cores for the same size hollow unit may exist between manufacturers. As an example, the 8 x 8 x 16 hollow unit may range from about 50% to 63% solid, depending upon the size and number of cores. These variations may result from the need to obtain properties such as fire resistance, sound insulation, and the like.

Oversize Units

Costs of mortar and labor can both be reduced by the use of oversize units. One type of oversize unit that has been made commercially has a face 12″ high and 16″ long. Another type has a face 8″ high and 24″ long. Each is thus 50 percent larger than a standard unit. They have been produced from aggregate that is sufficiently light in weight so that a single 8″ thick unit weighs only about 33 lb. Consequently each block can be laid about as rapidly as a standard block, but wall construction is about 50 percent faster. The dimensional proportions of both block shapes in the finished walls are pleasing.

FIGURE 1 — Typical functional shapes



Screen Block

Open-faced block of many patterns are available for decorative uses, or for the purpose of partially screening walls or yards from either the sun or outside viewers. These screen block are made in a wide variety of patterns and are useful, both indoors and out, for such uses as fences and carport walls, sun screens, curtain walls, room dividers, and veneers and friezes. Only a limited number of patterns may be available in a single locality but arrangements can often be made for special production runs of other patterns made with rented molds.

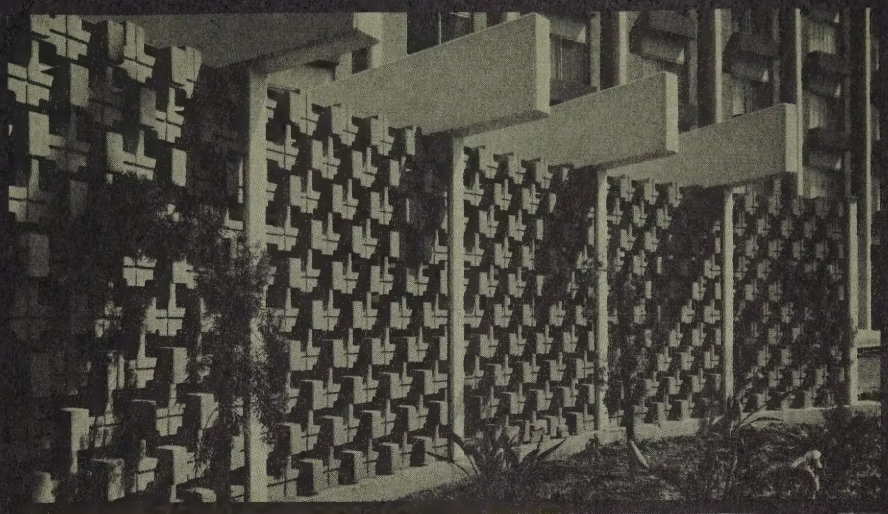
Floor and Roof Block

Floor and roof block offer the means of rapid but inexpensive construction of concrete floors, combined with excellent resistance to fire and sound. Such floors function as diaphragms and transmit wind loads or seismic loads through the walls to the foundation. Floor and roof block are of two types: filler block for joists and block for making plank.

Floor Filler Block

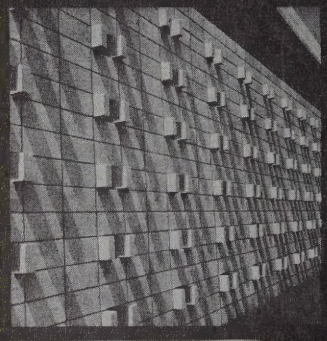
Filler block may be used to make the platform over which concrete joist floors may be cast in place. They are designed to be laid out on solid decking to provide the forms in which concrete joists are cast. The block are produced in sizes that vary from 4" to 12" deep. They are made with lightweight aggregate and contain hollow cores that constitute 40 to 60 percent of their volume so that they impose a considerably lower dead load than a solid concrete slab of equivalent load carrying capacity.

Another kind of filler block is designed to be supported on precast joist girders or beams. A floor slab is cast over the top to tie the whole system together.



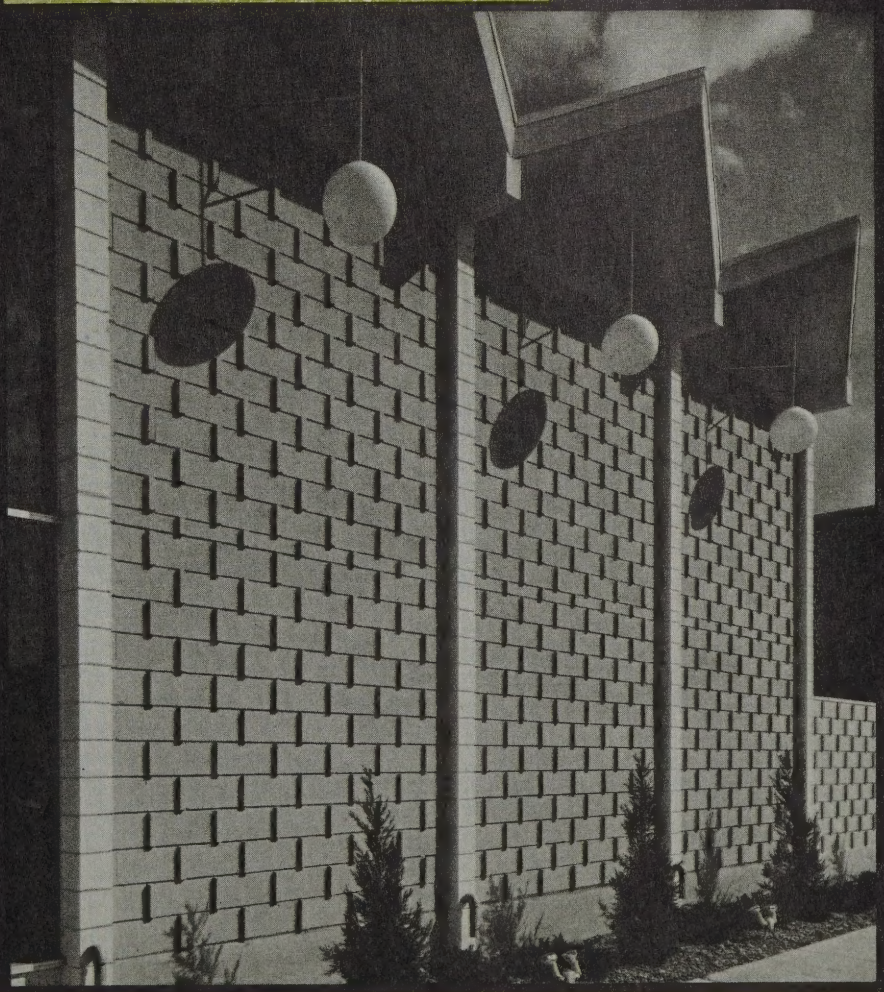
Block Plank

A number of systems are in use for assembling floor plank from high strength block units that contain openings for prestressing steel or reinforcing rods and grout. They are designed to provide initial camber in the plank which disappears under design load. Some systems are assembled with mild steel, some with post-tensioning steel grouted in the openings, and some with both reinforcing steel and post-tensioning steel.



Sound Block

Although all block can provide good resistance to sound reflection, one patented system provides an unusually high degree of sound absorption. Slotted openings in one face shell of the block permit entry of sound waves into the cores where their energy is dissipated through internal reverberation and absorption. They are useful in the noisy areas of schools, factories, mechanical equipment rooms, highway underpasses, wind tunnels and any other location where noise levels would otherwise be high. They may be used either in walls or as floor filler block. These block are patented, however, and may not be available everywhere.



Rapid Assembly System

A number of rapid assembly or mortarless systems have come into use in the past 20 years. These are systems that are designed for assembly by unskilled or partially skilled tradesmen using methods that do not require the use of a trowel in the traditional manner but may require a grout or plaster. Some of the better known systems are these:

An interlocking system that makes use of tight-fitting keys or plugs that tie adjacent block together. After being laid up dry the wall may be permanently tied together by plastering the surfaces and, if desired, by grouting vertical steel in some of the cores.

A tongue-and-groove interlocking system that is assembled by laying block up dry and bonding them by grout that flows through vertical and horizontal channels. Steel may be utilized in the channels if desired.

Wedge-shaped block that tightly interlock with double-V grooves in both directions. These are self-plumbing and self-aligning. Joints are sealed against moisture penetration by beads of waterproof sealer.

TABLE 2
Typical Values for Concrete Masonry Walls

Nominal Block Thickness, in.	Net Area, in.² per ft. length	Volume, in.³ per ft. length	Wall weight, psf					Section Modulus, in.³ per ft. length	Moment of per ft. length Inertia, in.⁴
			60 pcf(1)	80 pcf(1)	100 pcf(1)	120 pcf(1)	140 pcf(1)		
4	31.2	250	14	18	22	27	31	24	43
6	40.5	324	20	26	33	40	46	50	140
8	45.0	360	24	32	40	47	55	80	305
10	61.0	488	28	37	47	56	65	125	600
12	70.0	560	34	45	55	67	78	190	1105

(1) Unit weight of concrete in block

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